of Great Britain, and in particular whether any of them could be separated from the rest and compared with the Lewisian or Anglesea gneisses of undoubtedly pre-Cambrian age. When the mapping of these rocks by the Survey was begun many years ago, no attempt had been made by geologists to distinguish the various pre-Cambrian groups of rock now known to exist in Britain, and when the survey of the country was completed by the mapping of Donegal, all that could be definitely stated about the schists of that region was that they were in the main metamorphosed sedimentary deposits, like those of the central and south-western Highlands of Scotland, of which they were obviously a prolongation. No certain trace could there be found of any nucleus of still more ancient rocks upon which these altered sediments had originally been deposited. It was recognised, however, that in other parts of Ireland rocks had been met with in the course of the survey which presented some resemblance to so-called "Archæan" masses, but of which the stratigraphical relations and petrographical characters had not been worked out. It was thus possible that isolated areas of pre-Cambrian rocks might be detected if diligently sought for, and that in this way traces might be recovered of the earliest topography of the region.

Some progress has now been made in this interesting search, and successful results have been obtained, whereby the mapping of the older formations has been materially improved. In the west of Tyrone and the adjacent borders of Donegal a group of rocks was found to present many of the typical characters of the Lewisian gneiss of the north-west of Scotland. Mr. McHenry, who first suggested the true nature of these rocks, was instructed to map them out in conjunction with Mr. Kilroe. They were found to occupy a clearly defined area and to be easily separable from the schists and quartzites of Donegal which are classed with the metamorphosed rocks of the south-western Highlands of Scotland. Unfortunately no distinct line of contact between the two groups of rock was traceable, though there could be little doubt that they must be separated by a great unconformability, and that the older gneiss had already acquired much of its present character before the deposition and metamorphism of the younger schistose series.

Probably the most important tract yet examined is that of the long ridge which runs from Sligo to Castlebar, and of which the Slieve Gamph or Ox Mountains form a conspicuous portion. Here Mr. McHenry has found that at the base of the younger series coarse conglomerates occur, made out of the gneiss, and lying apparently in violent unconformability upon the older rock. If this observation is confirmed, it will establish an important point, not only in Irish but in British geology. It will show that the metamorphosed sedimentary rocks which form now the schists that build up the central and north-western Highlands of Scotland and the north-west of Ireland lie upon the uneven surface of an ancient gneiss, which presents the characters of the Lewisian gneiss of Sutherland and Ross-shire.

SCIENTIFIC SERIALS.

American Journal of Science, March.—Continuity of the glacial epoch, by G. F. Wright. In opposition to the author's view that the erosion of the rocky gorge of the Ohio river and its tributaries was preglacial, Prof. Chamberlin has maintained that the most important part of this rock erosion was interglacial. The author summarises the leading facts concerning the American glacial epoch by supposing that the earlier portions of the tertiary period were characterised by low altitude of land and warm temperature up to near the pole. A period of slow continental elevation of the regions which are now covered by glacial drift was in progress late in the pliocene epoch. During this stage the fiords of northern Europe and America and the extensive rocky gorges, like those of the upper Ohio and its tributaries, were eroded. Owing to this elevation glacial conditions characterised all the higher latitudes of North America and Western Europe. The glaciated area then began to sink until the land was, north of the great lakes at any rate, several hundred feet lower than it is now. The channels of the Allegheny, the Susquehanna, and the Delaware rivers were silted up by glacial débris, but were re-excavated by torrents of clear water during the re-elevation of the continent consequent upon the melting of some thousands of feet of ice. There were doubtless many oscillations of the ice-front both during the general advance and the general retreat of the ice-sheet, but there does not seem to be any evidence of oscillations of the front sufficient to break the proper continuity of the period.—Deformation of the Lundy Beach and birth of Lake Erie, by J. W. Spencer. The inferred rate of terrestrial deformation in the Niagara district being 1·25 feet a century, it appears that before Niagara Falls can have receded past the Devonian ridge near Buffalo, the drainage of the upper lakes will have been turned into the Mississippi valley, which may require 7000 or 8000 years.—Six and seven-day weather periods, by H. Helm Clayton. The observation of barometric minima reveals many instances of six and seven-day periodicities lasting several weeks, and sufficiently striking to be easily recognised. In the case of successive individual storms, it was found that during an interval of about twenty-seven days, corresponding with a solar rotation, the storm tracts were found in groups, in each of which the cyclones all followed the same general direction, and were separated from each other by intervals of six or seven days, or in some cases by half these intervals.

Symons's Monthly Meteorological Magazine, March.—A wet February in Edinburgh, by the Editor. In different parts of Edinburgh observations of rainfall have been made for 116 years, the wettest previous February being 5·21 inches, in 1848, while this year the fall amounted to 7·62 inches at one station, or more than four and a half times the average.—Mild winter weather, by A. B. M. The writer points out that for a long time past (since the beginning of the century at least) we have had a conspicuously mild first quarter of the year every twelve or thirteen years. The average mean temperature for London for the first quarter for 130 years, according to Buchan, is 39°·8; the first quarter quoted is 1809, 42°·1, and the last 1884, 43°·6. According to this we might expect the first quarter of 1896 or 1897 to have a high mean temperature. With the exception of the first year, 1809, the mild quarters have been followed by fine, hot summers.

L'Anthropologie, tome iv. No. 6, November–December, 1893.—In 1891 Dr. Topinard was requested by the *New York Herald* to give his opinion as to the qualities that should be possessed by (1) *the perfect man*, and by (2) *the coming man*. He replied to the first question in a brief note which has since been embodied, with about 150 others of a similar character, in a work entitled "Ideals of Life," by Dr. Wallace Wood, of New York. Dr. Topinard now discusses the subject at greater length in an article on "Certain inferences and applications of Anthropology." From a natural history point of view, *the perfect man* is he who, with the highest sense of his own personality, can best adapt himself to circumstances, and possesses personal advantages which assure him, in the struggle for existence, pre-eminence over his fellows, over other species, and over the agencies and powers of nature. It is he who has the soundest mind in the healthiest body, and commands, especially, the greatest power of estimating the importance of his actions, and of making them conduce to the utmost to the satisfaction of his necessities, his interest, and his pleasure. From the social point of view, *the perfect man* is he who is the best adapted to that state; who possesses in the highest degree sentiments of fellowship, of justice, of altruism, of the distinction between good and evil, of duty, &c. which have been bequeathed to him by his ancestors, and which form the essential basis of our social organisation; who regards these principles as articles of faith, and makes them the invariable rule of his own conduct. From the psychological point of view, *the perfect man* is he whose brain is the healthiest, the most philosophic, the most capacious, and the most active; who comprehends and retains the most, and who can, with the best effect, draw upon his storehouse of knowledge at a moment's notice.—M. Ch. Féré contributes a short note on the relation of the length of the trunk to the height, in which he shows that the relative proportion becomes gradually less as the stature increases.—M. Salomon Reinach continues his criticism of the Eastern Mirage, and discusses, in this number, the influence exercised by Egypt and Assyria on the civilisation of Eastern Europe.—M. G. De Lapouge describes sixty-two crania taken from a modern cemetery at Karlsruhe. These crania had been previously measured by Dr. Wilser, directly after they had been cleaned, and very shortly after their removal from the vault, and it was agreed that these two anthropologists should publish the results of their observations independently, so that the modifications produced by drying might be studied, and that an estimate might be formed of the different results

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given by the craniometric methods of Broca and Jhering. M. Lapouge measured the skulls exactly one year after Dr. Wilser, and during the whole of that time they had been thoroughly dried under the sunny roof of his laboratory at Montpelier. He also made a double series of measurements of the length and breadth of the skulls, first, by Broca's method, with a pair of calipers, and secondly, with Ammon's sliding compass, and after the method of Jhering, in precisely the same manner as Dr. Wilser's observations had been made. The results obtained are exceedingly interesting, and show that, in competent hands, it is a matter of perfect indifference which instrument is used, and that although, as one would naturally expect, the cephalic index is slightly greater when Jhering's method is employed, yet the difference is so small as to be almost insignificant. By Jhering's method the mean index of the series is 82·54, while Broca's index is 81·87. Both the length and breadth of the skull appear to be somewhat increased by drying, and the value of the cephalic index is a little raised, that obtained by Dr. Wilser from the fresh skulls being 81·84, while M. Lapouge's measurements of the dried skulls gave an index of 82·54. It will be observed that the difference is almost exactly the same as the excess of Jhering's index over Broca's. The flattening of skulls under the influence of desiccation is a phenomenon well known to all anthropologists, and in the case of these Karlsruhe skulls the mean diminution of height was more than a centimetre, so that, although the hygrometric conditions under which skulls are measured do not seem to affect the cephalic index of a series to an appreciable degree, the vertical and transverse indices of damp and dry crania are not comparable with one another.

SOCIETIES AND ACADEMIES.

London.

Physical Society, March 9.—Prof. A. W. Rücker, F.R.S., President, in the chair.—Prof. O. Henrici, F.R.S., made a communication on mathematical calculating machines, especially a new harmonic analyser. After mentioning the general principles on which such machines are based, the author showed a new arithmometer devised by Prof. Selling, in which the jerky motions of the numeral wheels common in such instruments are eliminated, and the operations simplified. Another arithmometer of very compact design, named the "Brunsviga," had been placed on the table by Prof. Boys. The simple and ingenious "hatchet" integrator was then shown. It resembles a small hatchet with a tracing-point projecting at right angles to, and at the end of, the handle. Moving the point from near the centre of mass of any closed curve, round the curve once and back to the starting-point, the distance between the initial and final positions of the hatchet-head is a measure of the area of the curve. The instrument has been found very useful for indicator diagrams. A Hine and Robertson's planimeter (lent by Prof. Perry), an Amsler planimeter combined with a pentograph for measuring small areas, an Amsler integrator to give areas and first moments, and a beautiful sphere and cylinder rolling-integrator of great accuracy, by Coradi of Zürich, were shown, as well as an ingenious integraph devised by Abdank Abakonowitcz. Passing on to harmonic analysers, Prof. Henrici explained the object of such instruments, viz. to determine the coefficients in Fourier's expansion for any periodic curve,

$$y = A_0 + A_1 \cos\theta + A_2 \cos 2\theta + \ldots + B_1 \sin\theta + B_2 \sin 2\theta + \ldots$$

and briefly described Lord Kelvin's instrument now in use at the Meteorological Office. This machine gives the first term and three pairs of coefficients A and B, but is large and expensive. The author had endeavoured to devise a simple and more portable instrument, and now described the various stages in the evolution of his new analyser. Using Clifford's method of wrapping the curve round a cylinder, he saw that by imparting a simple harmonic motion to a plane tangential to the cylinder, which plane carried an Amsler planimeter whose tracing-point followed the intersection of the plane with the curve, as the cylinder rotated, any coefficient A_n or B_n could be determined. This arrangement had considerable friction, and only gave one coefficient at a time; it also necessitated readjustment of the period of the harmonic motion for each pair of terms. Another machine founded on integration by parts was then constructed, in which the relative periods of cylinder and registering wheels was adjusted by a disc and roller, the motion being transmitted to the wheels by bands driven from the disc spindle. This gave A_n and B_n at one operation. Mr. A. Sharp used this machine for some time and then designed an inversion of it, in which the curve was laid out flat and the machine rolled over it. This arrangement greatly facilitated the multiplication of registering wheels, and thereby enabled several pairs of coefficients to be determined at once. The first machine of this kind showed several small errors which were avoided in a second instrument, a specimen of which, made by Coradi, was exhibited and described. A rectangular frame carried on three rollers (two being fixed to the ends of a long axis) traverses the paper in the direction of y, and the tracing point is fixed to a carriage which moves on the frame in a direction perpendicular to y, *i.e.* in the direction of θ. A band is attached to this carriage and imparts a motion proportional to θ to two horizontal axes (one for the A coefficients, and one for the B's), placed above and parallel to the long roller axis above mentioned. Each of the two axes carries five pinions having teeth in the ratios 1, 2, 3, 4, 5, respectively, which gear with crown wheels fixed to vertical spindles. The latter, therefore, rotate through angles proportional to θ, 2θ, 3θ, 4θ, and 5θ. To the lower ends of these spindles horizontal rings are attached, in which the bearings of a registering wheel are formed; each wheel rests on a cylinder carried by the long axis, and rolls or slides thereon according as its axis is parallel or perpendicular to that of the cylinder. Moving the tracing-point once round the curve gives five pairs of coefficients. By changing the driving-band to other pulleys so as to turn the pinions at different rates relative to the θ movement, the 6th, 8th, 10th, and 7th and 9th pairs can be determined. The chief drawback of the instrument is that the registering wheels are not easy to read, whilst the back-lash of the crown wheels and pinions introduces small errors. In the latest form of instrument toothed wheels are dispensed with, and glass spheres carried in frames on the vertical spindles roll on the horizontal cylinders; each sphere actuates two registering wheels on fixed areas at right angles to each other, and these give respectively the sine and cosine coefficients. The number of vertical spindles is therefore halved, and the instrument greatly simplified. These details have been introduced by Coradi. A working drawing of another analyser, designed by Mr. Sharp, which gives the amplitude and epoch of the curve resulting from each pair of terms in Fourier's expansion, was exhibited. The discussion on Prof. Henrici's communication was postponed until next meeting.—Mr. H. Wilde, F.R.S., then exhibited and described his "magnetarium." This consists of a hollow geographical globe, wound all over the inner surface with insulated wire in planes parallel to the equator. Within this globe is a sphere wound with wire on its surface, and having its axis inclined at 23½° to that of the outer globe. By means of epicyclic gearing the spheres can be made to rotate at slightly different rates. When electric currents of suitable strength are passed through the two windings, the magnetic condition of the earth can be imitated, both as regards distribution at any epoch, and the secular variations. A better result was obtained by putting sheet iron over the land areas, and a still closer approximation by using thin iron over the water areas. A magnetic chart and tables giving the magnetic elements at various places for different epochs as determined by the magnetarium were shown. The author mentioned that recent observations by the United States Survey at Ascension Island, and by Prof. Thorpe in Senegambia, had confirmed results obtained by his instrument. The President said he had tried the apparatus, and found the Siberian oval closely imitated. The secular variations at Greenwich were also well shown. In South America the approximation was not so good. In reply to a question by Mr. Blakesley, Mr. Wilde said the present position of the pole of the inner sphere was 84° W., 67° N.

Geological Society, March 7.—Dr. Henry Woodward, F.R.S., President, in the chair.—The Secretary announced that a portrait of the late Sir Richard Owen had been presented to the Society by Mr. Ernest Swain.—The following communications were read:—The systematic position of the Trilobites, by Mr. H. M. Bernard. The author, in his work on "The Apodidæ," endeavoured to show that *Apus* was the ancestral form of all existing crustacea except the ostracoda,

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